DOE/PC/92159--T14

TECHNICAL PROGRESS REPORT NO. 12 JULY-SEPTEMBER 1995

DE-AC22-92PC92159
CE Inc. Contract 10392

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TECHNICAL PROGRESS REPORT NO. 12 JULY-SEPTEMBER 1995

U.S. DEPARTMENT OF ENERGY

PITTSBURGH ENERGY TECHNOLOGY CENTER

CONTRACT DE-AC22-92PC92159

FOR

ENGINEERING DEVELOPMENT OF ADVANCED COAL-FIRED

LOW-EMISSION BOILER SYSTEMS

SUBMITTED BY:

ABB POWER PLANT LABORATORIES
COMBUSTION ENGINEERING, INC.

1000 PROSPECT HILL ROAD

P.O. BOX 500

WINDSOR, CONNECTICUT 06095-0500

NOVEMBER 27, 1995

DISCLAIMER

PATENT STATUS

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

The Pittsburgh Energy Technology Center of the U.S. Department of Energy (DOE) has contracted with Combustion Engineering, Inc. (ABB CE) to perform work on the "Engineering Development of Advanced Coal-Fired Low-Emission Boiler Systems" Project and has authorized ABB CE to complete Phase I on a cost-reimbursable basis and Phases II and III on a cost-share basis.

The overall objective of the Project is the expedited commercialization of advanced coal-fired low-emission boiler systems. The goals for emissions and plant efficiency are:

- NO_X emissions not greater than 0.1 lb/million Btu.
- SO_X emissions not greater than 0.1 lb/million Btu.
- Particulate emissions not greater than 0.01 lb/million Btu.
- Net plant efficiency (HHV basis) not less than 42%.

Other goals include:

- Improved ash disposability and reduced waste generation.
- Reduced air toxics emissions.

The final deliverables are a design data base that will allow future coal-fired power plants to meet the stated objectives, and a preliminary design of a Commercial Generation Unit.

The work in Phase I covered a 24-month period and included system analysis, RD&T Plan formulation, component definition, and preliminary Commercial Generating Unit (CGU) design.

Phase II will cover a 15-month period and will include preliminary Proof-of-Concept Test Facility (POCTF) design and subsystem testing.

Phase III will cover a 9-month period and will produce a revised CGU design and a revised POCTF design, cost estimate and a test plan.

Phase IV, the final Phase, will cover a 36-month period and will include POCTF detailed design, construction, testing, and evaluation.

The Project will be managed by ABB CE as the contractor and the work will be accomplished and/or guided by this contractor and the following team members:

- DOE Contracting Officer's Representative (COR)
- ABB Combustion Engineering Systems (ABB CES)
- ABB Environmental Systems, Inc. (ABBES)
- Raytheon Engineers and Constructors, Inc. (RE&C)
- Dr. Janos Beér, MIT and Dr. Jon McGowan, U. of Mass.
- Association of Edison Illuminating Companies - Power Generation Committee (AEIC)
- Advanced Energy Systems Corporation (AES)
- Black Beauty Coal Company
- Electric Power Research Institute (EPRI)
- Illinois Clean Coal Institute (ICCI)
- Peridot Chemicals, Inc.
- Richmond Power & Light (RP&L)
- Southern Company Services, Inc. (SCS)

SUMMARY

The project is under budget and generally on schedule. The current status is shown in the Milestone Schedule Report included as Appendix A. Task 7 - Component Development and Optimization and, Task 11 - Subsystem Test Operation and Evaluation are shown to be behind schedule. Also, addition of Kalina technology has put the completion date for Task 8 at risk. However, Phase III will be completed on schedule. Technology Transfer activities included delivering a technical paper to the PETC "Contractors" Conference, supplying a Poster Session and paper for the Pittsburgh Coal Conference and submitting an abstract of a paper for the '96 CSTA conference.

Preparations were completed for the Task 7 200 acfm CeraMem filter test at Alabama Power Co. The test is scheduled to start on October 1; however, the schedule depends on resolving non-technical problems in the Site Agreement. At the close of this reporting period these negotiations were proceeding very slowly and there is concern that agreement will not be reached.

Task 7 activities (Computational Modeling, Fundamental Scale Burner Facility testing, Pulverizer Development Facility modifications) in support of the October low-NO_X firing system test were essentially completed.

In Task 8 a feasibility study was performed to assess the suitability of incorporating a Kalina cycle in the POCTF. Based on positive responses of RP&L and PETC to the results of the study, it was decided to include a Kalina cycle in the scope of the POCTF preliminary design. The State of Indiana has specified that the POCTF project will require a PSD permit, and work began on preparation of the application and associated modeling for this permit.

The test designs and plans created in Task 9 were submitted in the previous reporting period, although the plan for the 5,000 acfm CeraMem filter test will be updated following completion of the 200 acfm test.

Task 10 work mainly consisted of design, fabrication and installation of new air, overfire air and coal nozzles in the Boiler Simulation Facility followed by shakedown of these components along with the automatic stoichiometry controls and the modified pulverizer with a dynamic classifier. The test equipment for the 5,000 acfm CeraMem filter test was shipped to the fabricator, inspected and cleaned. It will be modified based on results of the 200 acfm test.

Task 11 is scheduled to commence on October 1, 1995.

Plans for the next reporting period include: conducting the 200 acfm CeraMem filter test, resuming work on the POCTF preliminary design (with a Kalina cycle), submitting a PSD application for the POCTF, conducting both low-NO_X firing system tests and initiating the 5,000 acfm CeraMem filter test.

TASK 1 - PROJECT PLANNING AND MANAGEMENT

All work in Task 1 and all Task 1 deliverables for the reporting period were completed on schedule. All quarterly reports and all monthly Status, Summary, Milestone Schedule, and Cost Management reports were submitted on schedule.

Annual updates of the following plans were prepared and submitted:

- Management Plan (including Work Plan)
- Milestone Plan
- Cost Plan
- QA/QC Plan
- Notice of Energy R&D

Following completion of the POCTF/RP&L/Kalina feasibility study, the results were presented to RP&L and to DOE. It was agreed that we would use a Kalina cycle in the preliminary design of the POCTF (Subtask 8.2) and the CGU (Task 13) and resume work on Subtask 8.2.

Regarding the schedule for Contract Item .002 (Phases II and III), several testing activities are behind schedule but this situation will not affect the completion date of Phase III or the Phase III deliverables, *i.e.*, the updated CGU and POCTF preliminary designs and the POCTF Test Plan. The testing activities which are behind schedule are CeraNO$_x$ filter testing (Tasks 7, 10 and 11) and Low-NO$_x$ Firing System testing (Task 11). The delays are either intentional due to reduced FY95 funding or are caused by cancellation of access to a utility unit. Addition of Kalina technology has removed all float from the Task 8 schedule and put the completion date for Task 8 at risk. However, Phase III will be completed on schedule.

Technology Transfer activities consisted of the following:

- Presented a LEBS paper at the Eleventh Annual Coal Preparation Utilization, and Environmental Control Contractors Conference entitled "Pushing the Pulverized Coal Envelope With LEBS". A copy of the paper is included as Appendix B.
- Supplied a Poster Session and wrote a LEBS paper entitled "Development and Design of an Advanced Pulverized Coal-Fired System" for the Twelfth Annual International Pittsburgh Coal Conference. A copy of the paper is included as Appendix C.
- Submitted an abstract of a LEBS paper for the 21st International Technical Conference on Coal Utilization & Fuel Systems.

TASK 7 - COMPONENT DEVELOPMENT AND OPTIMIZATION

SNO_X™ Hot Process

A site visit was made to Alabama Power Company's Plant Miller to finalize the site location for the 200 acfm system. The best location for the system is outdoors on the roof between the boiler house and the Unit 2 precipitator. The system would draw fly ash-laden flue gas from the hot-side ESP inlet duct and return the flue gas and ash to the ESP inlet duct.

Due to a staffing change at CeraMem, ABBES has assigned personnel to assist CeraMem. The schedule has been revised to show a Start Test date of 10/1/95 and a Complete Test date of 11/1/95.

ABBES is responsible for purchase orders to Birmingham Industrial Services to provide site preparation and installation services. ABBES engineering provided an initial review of CeraMem's P&ID and Bill of Materials. (CeraMem is responsible for ordering materials.) CeraMem is also responsible for overseeing fabrication of the test skid and for the design, installation, and operation of the control system. CeraMem worked with ABBES and Southern Research Institute (SRI) during the month of August to prepare a complete description and design of the control system.

SRI will provide analytical support with the additional requirement of providing the outlet sample and conditioning system and recording continuously the outlet NO_X and NH_3 concentrations using instrumentation provided by CeraMem.

A video-conference meeting was held August 7 to finalize Bill of Materials and engineering issues for the system. The purpose of the meeting was to review the 200 ACFM P&ID with emphasis on the control system, data logging, and analytical measurements to be made during testing.

ABBES issued the following purchase orders:

- Site Preparation and Erection to Southern Energy Constructors
- Ammonia Supply to Post Specialty Gases
- Gas Analyzer Instrument Rental to Clean Air Engineering.
- Field Sampling and Analytical Work to Southern Research Institute

CeraMem issued purchase orders for equipment needed for the skid. Equipment was identified by ABBES on a Bill of Materials. CeraMem issued a purchase order to SRI for preparation of the two sampling and conditioning systems to be installed on the unit.

Fabrication of the compartment housing was completed and the unit was shipped to the fabricator for installation into test skid.

ABBES designed and ordered components for the control system which was manufactured in Birmingham and will be installed on the system at the site. Equipment for the test was delivered to Plant Miller.

The test plan was revised to include recent data and previous results. The test is on hold pending resolution of the site access agreement.

An Environmental Questionnaire (NEPA) for the host site has been completed and forwarded to DOE.

Low-NO_X Firing System

The overall objective is to develop an advanced firing system which reduces the NO_X emission levels leaving the primary furnace to 0.10 lb / MMBtu or lower while maintaining carbon in ash at 5% or less. Included in this scope is an integrated effort combining Computational Modeling, fundamental scale evaluation of firing system concepts performed in the Fundamental Scale Burner Facility (FSBF), characterization of the pulverizer system performance utilizing the Pulverizer Development Facility (PDF), and pilot scale testing of the firing system in the Boiler Simulation Facility (BSF).

Computational Modeling: Data analysis, testing needs, and general support continued in preparation for the upcoming combustion testing in the BSF.

Heat flux distributions for each of the cases converged to date have been calculated and plotted in a manner typical of ABB CE design standards, giving confidence in design of the waterwalls (metal temperature calculations, materials selection and circulation system). In addition, calculated heat flux distributions for each of the furnace configurations have been plotted and compared to TFS 2000™, with the results from the TFS 2000™ configuration matching reasonably well with field data. Although there are definite differences with alternate firing arrangements, the peaks are similar to TFS 2000™. Resident time / stoichiometry histories for the TFS 2000™ and alternates were calculated, plotted, and analysis is in progress.

The evaluation of the PSR Chemkin model continued. Although a single PSR reactor model was successfully set up and run, a multiple PSR reactor model was not successfully run due to the carry over of negative (although small) numbers. Results from this work are currently being wrapped up and documented.

Advanced Fuel Staging/Coal Reburn: Data analysis of advanced vertical staging concepts performed in the FSBF were completed. Results from these tests have been incorporated into the test plan for the upcoming BSF testing.

Corrosion testing of various materials in an electrically heated carbolite furnace was completed. Testing was performed on a six (6) section test probe exposed to a simulated low NO_X gas environment. The test probe was

embedded with particulate and deposit samples obtained from previously performed combustion testing of the TFS 2000™ furnace arrangement in the BSF. Analysis of these results is currently underway. Sacrificial corrosion and deposit probes were fabricated for the combustion tests. Additional preparation was performed to obtain in-furnace gas species measurements at similar locations.

Coal Pulverization: The construction of the classifier test facility was completed, although testing was delayed due to permitting issues. CFD modeling looking at the effects of particle and velocity inputs from the lower pulverizer CFD model to the classifier model was completed. These results are currently under evaluation. CFD modeling of the lower half of the pulverizer continues.

The PDF was configured with the dynamic classifier design which will be used for the pulverization of coal for the upcoming combustion tests. This configuration produces a fuel grind of 90% less than 200 mesh for this testing.

The fuel transport system was shaken down and the fuel was prepared for BSF combustion tests.

TASK 8 - PRELIMINARY POC TEST FACILITY DESIGN

Site Selection

In October of 1994 ABB CE formally accepted the Richmond Power & Light offer of Whitewater Valley Unit No. 1 as the host site for the Proof-of-Concept Test Facility.

Preliminary Design

As an initial step in assessing the suitability of incorporating ABB's Kalina cycle technology in the LEBS Project, it was decided to conduct a feasibility study of the Proof-of-Concept Test Facility (POCTF) with a Kalina cycle. A Work Plan for this Kalina Feasibility Study was prepared and submitted by Raytheon. Approval of the plan and authorization to start work was subsequently given at the beginning of the reporting period.

The Kalina Feasibility Study for the POCTF was conducted to develop an initial, site-specific evaluation of a Kalina cycle conversion of Whitewater Valley unit 1, using an order-of-magnitude engineering analysis. It was intended that if the findings of this study were favorable, the next step would be to incorporate a Kalina cycle in the scope of the upcoming POCTF preliminary design. As such, the feasbililty study was structured to achieve the following objectives:

- perform a technical feasibility assessment,
- define the project technical scope, and
- develop order-of-magnitude estimates for
  - unit performance and,
  - project cost (+/- 20%).

The study was completed in early September. For the study, the following engineering work products were prepared at the conceptual level:

- definition of the project scope, delineated by systems and type of work. (See Table 1.)
  - demolition
  - new systems
  - modified systems

- system schematics
  - mechanical system flow diagrams
  - electrical single line diagram
  - control system block diagram

- general arrangement sketches

- performance estimates
  - cycle heat balance
  - unit net output and heat rate

- equipment lists
  - mechanical
  - electrical
  - instruments and control valves

- mechanical, electrical and controls equipment
  - sizing
  - budgetary cost quotations

- pipe sizing and quantity takeoffs

- conceptual design of structural components
  - building addition
  - turbine pedestal modifications
  - boiler support system modifications

- project cost estimate

- system descriptions

The results of the Kalina Feasibility Study were reviewed by the team at ABB's offices in Windsor, CT in early September followed by presentations to Richmond Power & Light (RP&L) and DOE/PETC, in their respective offices.

As a result of positive responses from RP&L and PETC to the potential of the Kalina cycle, as developed in the feasibility study, it has been decided to incorporate a Kalina cycle in the preliminary design of the POCTF.

Licensing

Interaction with the Indiana Department of Environmental Management (IDEM), for preparation and processing of state-level permits for the POCTF project, continued.

IDEM has specified that the project will require a PSD permit for sulfuric acid mist emissions, and that dispersion modeling of these emission will be required to support the PSD application.

A PSD pre-application meeting was first held with IDEM in their offices in Indianapolis for the nominal purpose of obtaining IDEM guidance on PSD application format, modeling protocol and allowable sulfuric acid mist concentrations. The meeting attendees were IDEM, Raytheon, RP&L and ABB. This meeting agenda was expanded somewhat to include:

- Project background and status.
- Introduction to the Kalina cycle.
- PSD permit application procedures.

Work on preparation of the PSD permit application was initiated, and good progress was made. A target date of December 1, 1995 has been set for submittal of applications to IDEM for the PSD permit and the state construction permit.

Preliminary dispersion modeling of sulfuric acid mist emissions was completed, using a screening model. This type of model produces conservatively-high (that is, upper-limit) estimates of ambient concentrations of a given pollutant. These results predicted very low concentrations of sulfur acid mist. Specifically, under a number of potential operating scenarios, maximum concentrations of less than 10 ug/m^3 were calculated. It is expected that these low concentrations will not pose a licensing issue.

At the PSD pre-application meeting, IDEM deferred from specifying maximum allowable sulfuric acid mist concentrations due to a lack of experience with this pollutant. They have instead elected to contact the EPA regional office for direction, and the licensing team is maintaining an on-going dialog with IDEM on this issue to attempt to expedite its resolution.

Raytheon and ABB also met with the PETC environmental group to review plans for satisfying the NEPA compliance requirements. As of the meeting, the project team had prepared and submitted to PETC all of the appropriate background documentation, and PETC agreed to start reviewing this material in November of this year. The PETC personnel stated, however, that they will not undertake major NEPA compliance activities for the POCTF before late 1996, following the selection of a single Phase IV contractor.

Table 1

PROJECT SCOPE
POCTF WITH KALINA CYCLE

DEMOLITION

Mechanical

- Steam Generator & Auxiliaries
- Turbine-Generator & Auxiliaries
- Main Steam
- Condensate
- Feedwater
- Extraction Steam & Heater Drains
- Blowdown & Boiler Drains
- Bearing Cooling Water

Electrical

- Generator and Accessories
- Generator Transformer (by RP&L)
- Non-segregated Bus Duct (by RP&L)
- Auxiliary Power Transformer No. 1
- Auxiliary Power Transformer No. 2

Structural

- Turbine Hall West Wall

I&C

- Boiler Control Board (incl. with SNO_x)
- Turbine Control Board
- Misc. Instruments
- Misc. Control Valves

Table 1
(Cont'd)

NEW SYSTEMS

Mechanical

- Boiler & Auxiliaries
- Turbine-Generator & Auxiliaries
- Condensate
- Feed Heating
- Evaporator
- High Pressure Vapor
- Intermediate Pressure Vapor
- Low Pressure Vapor
- Lean Solution
- Intermediate Solution
- Sootblowing Air
- Ammonia Supply
- Ammonia-Water Drain & Vents
- Closed Cooling Water
- Ammonia Blowdown & Recovery
- Turbine Gland Leakage Recovery
- HVAC
- Draft (incl. with SNO_x)
- Flue Gas Cleanup (incl. with SNO_x)

Electrical

- Generator Transformer (by RP&L)
- Nonsegregated Bus Duct (by RP&L)
- Generator & Accessories
- Medium Voltage Distribution (4.16 kV)
- Low Voltage Distribution (480V)
- Direct Current
- Uninterruptible Power Supply

Structural

- Heat Exchanger Building
- Foundations for Outside Tanks & Acc.
- Foundations for Aux. Transformers

I&C

- Distributed Controls & Accessories (partial with SNO_x)
- Misc. Instrumentation
- Misc. Control Valves

Table 1
(Cont'd)

MODIFIED SYSTEMS

Mechanical

- Circulating Water
- Flyash
- Bottom Ash
- DI Water Treatment
- DI Water Storage & Transfer
- Service & Instrument Air
- Service Water
- Fuel Oil
- Fire Protection

Electrical

- Grounding & Lightning Protection
- Plant Communications
- 2400V Switchgear
- Lighting
- Relocate LIFAC Transformers

Structural

- Turbine-Generator Foundation
- Boiler Support System
- Auxiliary Transformer Foundations

TASK 9 - SUBSYSTEM TEST DESIGN AND PLAN

SNO_X Hot Process

The Subtask 9.2 Test Plan was submitted to DOE for their approval/comments. The Plan will be finalized by adding details generated in Task 7.

A meeting was held with Alabama Power Company to assess their involvement with the 5000 acfm test. A site was selected, which is located near the EPRICON system within the Unit #3 boiler house. Fly-ash laden flue gas is available at adequate temperature, reducing the amount of heat input required.

Due to a staffing change at CeraMem, ABBES has added engineers to the project to assist CeraMem. The task schedule has been revised to show a Start Test date of 12/1/95 and a Complete Test date of 2/1/96.

A formal engineering meeting between CeraMem and ABBES took place September 19 in Birmingham. Equipment requirements for the system were identified and initial procurement was started.

An Environmental Questionnaire (NEPA) for the host site has been completed and forwarded to DOE.

Low-NO_X Firing System

Completed in a previous reporting period.

TASK 10 - SUBSYSTEM TEST UNIT CONSTRUCTION

SNO_X Hot Process

CeraMem contracted with ADA of Englewood, CO to remove the "Comanche" test system and transport it to a Birmingham fabrication shop. The system was dismantled, removed from the Colorado site, shipped to Birmingham and has been inspected. The system appears to be in good shape and has been sent to the fabricator, where it has been dismantled and cleaned. The fabricator is awaiting shop drawings and instructions.

Task 10 (and most likely Task 11) will finish behind schedule. However, Phase III will be completed on schedule.

Low-NO_X Firing System

Design and fabrication of auxiliary and close coupled overfire air (CCOFA) nozzles was completed. High capacity CCOFA nozzles were selected to allow for the testing of low cost, integrated low NO_X firing systems. Separate Over Fire Air (SOFA) nozzles, capable of both tilt and yaw, were designed and fabricated. The as-designed secondary air nozzles will allow for up to +/- 20 degree yaw or tilt by removing and rotating the externally adjustable assembly to allow for the testing of varied auxiliary air configurations.

One of two coal nozzle tips to be tested was also designed and fabricated. This tip is designed to accommodate a broad range of coals while potentially reducing NO_X emission over other, existing coal nozzle tip designs.

The design and fabrication of modifications to the existing main burner region combustion air windboxes necessary to allow for the measurement of secondary air flow to each of the sixteen available compartments was completed. The new windbox design will utilize individual pitot probes for flow measurement, installed in modified windbox air feed ducts, with an inclined manometer for static and delta pressure measurements. This capability will (for example) support the testing of vertically staged windbox scenarios, and firing system alternates designed to reduce the backpass gas side imbalance.

Installation of new windboxes and all remaining firing system components was completed in August.

A change in the coal selected for BSF testing was made in August. The originally selected, low sulfur Rend Lake coal (a cleaned Illinois #6 coal) was replaced by the high sulfur (~2.7% dry) Viking coal. This change was made to better meet the objectives of the project which specifies the use of high-sulfur coals. The Viking coal is presently fired at Richmond Power and Light, the proposed site for the proof-of-concept test facility. The 2.7%

sulfur Viking coal was pulverized to a grind of 90% minus 200 mesh for the firing system testing using the pulverizer development facility (PDF) configured with a dynamic classifier.

The test matrix was revised and finalized.

Due to several minor delays in the shakedown of the various firing system components and the new controls, testing which was originally scheduled for the week of September 24 was postponed one (1) week until the first week of October.

TASK 11 - SUBSYSTEM TEST OPERATION AND EVALUATION

BSF testing is scheduled to begin on Sunday night, October 1, 1995 and continue around the clock through Friday, October 6, 1995. Recorded data will include outlet emissions (O_2, CO, CO_2, SO_2, NO, NO_X), iso-kinetic fly ash samples, limited scale suction pyrometry (furnace outlet temperatures), in-furnace solid sampling (high volume) and in-furnace gas species concentrations. Additionally, sacrificial probes will be installed to collect ash deposits for the duration of the testing for examination of corrosion related issues.

A literature review is in progress which will evaluate the projected control limits of hazardous air pollutants (HAPS) (from both a technical and regulatory standpoint) and determine if there may be concern with the control of these emissions relative to the LEBS firing system currently being developed.

PLANS FOR NEXT QUARTER

Task 1

- Estimate cost and identify funding source for the addition of a Kalina cycle to the CGU preliminary design (Task 13).

Task 7

- Complete CFD and kinetic modeling for the low-NO_X firing system.
- Conduct 200 acfm CeraNO_X test.

Task 8

- Prepare and submit to Indiana Department of Environmental Management the PSD application, including the associated dispersion modeling, for the POCTF at Richmond Power & Light.
- Resume work on the POCTF preliminary design, incororating a Kalina cycle.

Task 9

- Complete the test plan for the 5,000 acfm CeraNO_X test.

Task 10

- Complete reconfiguration of the test rig for the 5,000 acfm CeraNO_X test.
- Modify the Boiler Simulation Facility (BSF) for the second low-NO_X firing system test series.

Task 11

- Initiate the 5,000 acfm CeraNO_X test.
- Conduct the second BSF test series.

APPENDIX A - 2 pages

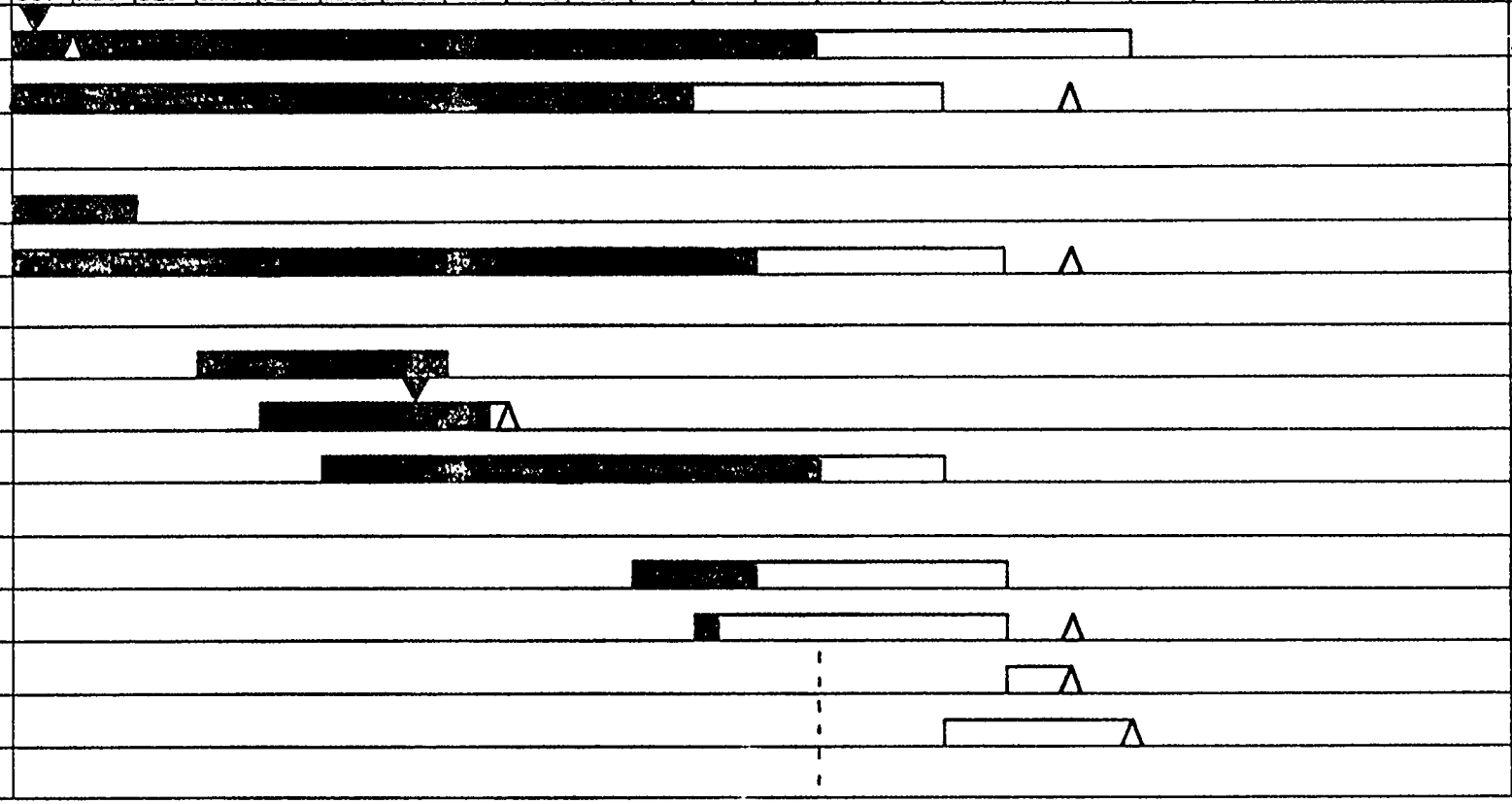
U.S. DEPARTMENT OF ENERGY

DOE F1332.3
(11-84)

MILESTONE SCHEDULE ☒ PLAN ☒ STATUS REPORT

FORM APPROVED
OMB 1901-1400

1. TITLE	2. REPORTING PERIOD	3. IDENTIFICATION NUMBER
Engineering Development of Advanced Coal-Fired Low-Emission Boiler Systems - Phases II & III	Oct. 1, 1994 – Oct. 31, 1995	DE-AC22-92PC92159
4. PARTICIPANT NAME AND ADDRESS Combustion Engineering, Inc. P.O. Box 500 Windsor, CT 06095-0500		5. START DATE October 1, 1994 6. COMPLETION DATE September 30, 1996



7. ELEMENT CODE	8. REPORTING ELEMENT	10. PERCENT COMPLETE PLAN	ACTUAL
1.0	Prj Mgt	54	54
7.0	Comp Dev	89	75
8.0	POCTF		
8.1	Site Sel	100	100
8.2	Pre Dsn	72	67
9.0	Subsyst		
9.1	Design	100	100
9.2	Plan	100	95
10.0	Constr	93	90
11.0	Subsyst		
11.1	Oper	37	33
11.2	Test Ev	38	7
11.3	Dsn Ev	0	0
12.0	Draft Report	0	0

11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE

John W. Regan Nov. 10, 1995

U.S. DEPARTMENT OF ENERGY

DOE F1332.3
(11-84)

MILESTONE SCHEDULE ☒ PLAN ☐ STATUS REPORT

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7. ELEMENT CODE	8. REPORTING ELEMENT	9. DURATION FY96																					FY	FY	10. PERCENT COMPLETE	
	PHASE III	APR	MAY	JUNE	JULY	AUG	SEPT																		Plan	Actual
1.0	Prj Mgt																									
13.0	CGU Dsn																									
14.0	POCTF																									
14.1	Rev Dsn																									
14.2	Test Plan																									
15.0	Report																									

11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE

APPENDIX B - 14 pages

Conference paper "Pushing the Pulverized Coal Envelope with LEBS" removed for separate cycling. dt

APPENDIX C - 13 pages

Conference paper "Development and Design of an Advanced Pulverized Coal-Fired System" removed for separate cycling. at